other writers, and Prof. Beck remarks that, since the aqueous solutions in the fissures cooled very slowly, and "their great liquidity was extremely favourable to diffusion of the dissolved substances, crystals of large size are frequently found in pegmatites." While thermal waters found their way to upper parts of the crust, the solutions that resulted in pegmatite-veins represent material retained at considerable depths. Hence ore-deposits associated with pegmatites become exposed only after long ages of denudation. Prof. Beck cites several examples where tin, copper, and gold are among the substances deposited in connection with pegmatites.

Dr. G. B. Trener (*Verhandlungen der k.k. geol. Reichsanstalt*, 1905, pp. 366 and 372) is conducting experiments to show that metals undergo diffusion in solid crystalline rocks at temperatures far below the melting points of the metals employed. The complete results are to be published in the *Jahrbuch* of the Reichsanstalt as a chapter of the description of the Cima d'Asta, but the preliminary announcements have already aroused discussion. Among the curious points raised by Dr. Trener, is the resistance of mica to diffusion of metals in a direction perpendicular to its cleavage planes; well-developed mica-schists may thus be practically impenetrable when their foliation-planes are perpendicular to the direction of diffusion.

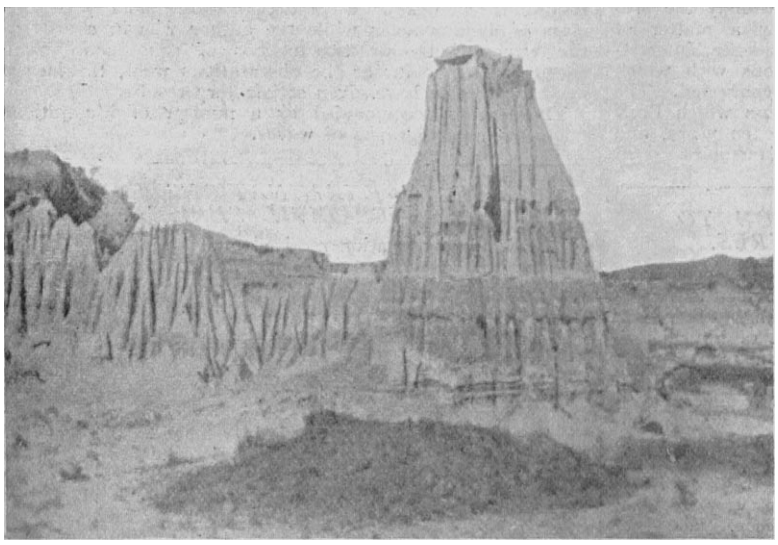

FIG. 2.—Earth-pillars, south of Alkmaar, Transvaal.

The Report of the Geological Survey of the Transvaal for 1904 has been noticed already in NATURE (vol. lxxiv., p. 646). The volume for 1905 has now been issued, dated August, 1906, liberally illustrated with plates and coloured geological maps and sections, and at the same moderate price of 7*s*. 6*d*. The director, Mr. H. Kynaston, describes a recent survey of the Komati Poort coalfield, which is conveniently situated on the Delagoa Bay side of the country. He reminds us of the record of 25 feet of coal in 33 feet of strata passed through by a bore-hole near Tenbosch Station in 1903, and remarks that this massive seam may underlie the smaller ones that have been proved at various points. Arguments are given to show that the horizon of these coal-bearing beds, and those of the Transvaal generally, may be in the Beaufort series, and not in the underlying Ecca series, as has been generally supposed (p. 25). Mr. Kynaston also describes a Coal-measure series (p. 35) in the Bushveld area west of the Pietersburg railway. The igneous rocks of this region present many points of interest, especially in the occurrence of bands of magnetite, resembling dykes, associated with, but not passing into, a considerable mass of norite. Similar bands are well dealt with by Mr. Hall in a later paper in this report (p. 73). Our field-inspection of these iron ores, under the guidance of Mr. Kynaston, would certainly suggest that they were igneous intrusions of an extremely basic type.

Mr. A. L. Hall (p. 41) describes the fine country between Lydenburg and the Devil's Kantoor, or Devil's Shop, so-called from the fantastic weathering of the sandstone masses near the edge of the great escarpment. Gold-mining is carried on in this hilly region, and a lime industry has sprung up near Godwan River Station through the working of secondary deposits of calcite in the dolomitic series. Mr. Hall, we think wisely, introduces the descriptions of the microscopic characters of his rocks, as explanations of their structure, side by side with the account of their features in the field. A rock believed to be a tuff is interestingly recorded (p. 53) among the otherwise intrusive igneous masses found in the Transvaal system. The fine illustrations to the report show the escarpment of the Kantoor quartzite, with the rapid descent towards the old granite on the east; the gorge in the far younger quartzite of the Pretoria series, between Waterval Boven and Waterval Onder, where the traveller from the monotonous plateau of the Transvaal welcomes the picturesque notching of its edge; and other scenes from this noble region, including the weathered quartzite (Fig. 1) of the Kantoor itself.

Another photographic illustration (Fig. 2) shows the detrital sand resulting from the weathering of the older granite, which is now eaten out into pillars as much as 25 feet high, with sometimes a cake of more resisting rock upon the top.

Passing over other papers in this report, as unfortunately must be the case in a general notice, we may mention Mr. Mellor's account of the Witbank Coalfield near Middleburg on the main plateau (p. 81). The Permian glacial conglomerate has here supplied, during an epoch of denudation, much of the material of the overlying Beaufort (?) Coal-measures. The coal-seams, one of them being 24 feet thick, are described and illustrated by sections (p. 97, &c.). The presence of fine muddy layers raises the ash, even in some of the workable coal, to 17 per cent., and the ash rarely falls below 7 per cent.

Mr. Tweddill (p. 106), in a handsomely illustrated paper, describes some ruby-bearing rocks from the Leydsdorp district, notably a beautiful example consisting of a pale pyroxene, kyanite, and finely granular ruby. He holds out hopes, if we read him rightly, that ruby may be in time discovered on a scale of commercial importance in the Transvaal. G. A. J. C.

MEN OF SCIENCE IN AMERICA.

THE issue of *Science* for November 23 contains an article by Prof. McKeen Cattell on the selection, and arrangement in order of merit, of a thousand American men of science. A table was compiled from lists of fellows of societies, biographical dictionaries, "Who's Who," &c., of the numbers of persons engaged in each branch of science. It appears that chemists are the most numerous, in America at all events, forming 164 per 1000 of all scientific men, zoologists coming a close second with 155 per 1000. Anthropologists stand at the foot of the list with only twenty-three, but neither statisticians nor economists, it would seem, were taken into account. Ten leading representatives of each science were then asked to arrange in order of merit a certain number of students of that science, the numbers fixed being roughly proportionate to the totals in the table first compiled. The positions assigned by the different judges to every individual were averaged, and the probable error of the average posi-

tion of each calculated. A general list, including representatives of all the sciences, was also compiled by interpolation, but neither this nor the separate lists are published. An interesting table is given showing the divergences between the ten judges in the case of psychology, as an illustration. The order of merit given by one of the judges is very much more accordant with the average order than those of the others, and they differ considerably *inter se*, though more, if we understand the table rightly, in the case of those at the bottom of the list than of those towards the top. Of the first hundred scientific men on the list who are eligible, sixty-one are included among the ninety-seven members of the National Academy of Sciences. The discussion of the grades and probable errors is continued in *Science* for November 30, and in a third and concluding article in the issue for December 7 Prof. Cattell investigates the geographical distribution of American men of science, according to place of birth and place of residence. The figures as regards the former are extremely striking. The production or "birth-rate" of men of science per million of the population ranges from about 109 in Massachusetts—which stands far above the other States—and eighty-seven in Connecticut down to rates of only one or two in several of the southern States. It is argued that differences in stock can scarcely be great enough to account for this, and that accordingly the production of scientific men must be largely a matter of circumstance. As regards the place of residence, interesting tables are given showing the institutions with which the men of science taken into account are connected. The work forms part of an extended investigation which Prof. Cattell has now been conducting for some ten years, and on which he has published several previous memoirs.

WAVE ACTION IN RELATION TO ENGINEERING STRUCTURES.

A PAPER on wave action in relation to engineering structures, by Major D. D. Gaillard, issued as a professional paper (No. 31) of the Corps of Engineers of the United States Army, contains a great deal of information useful to engineers engaged in designing and constructing sea defences and other works subject to wave action.

The first part of the book is devoted to a general consideration of the theory of the formation of waves, and to a notice of the information that already exists as to this. This, as the author remarks, is embraced in so many volumes that the work of comparing theoretical and observed wave characteristics is rendered very tedious. The investigations that have previously been made into wave action, and of which the results have been published, relate principally to deep-water waves, whereas there is very little recorded information as to the action of waves in comparatively still water to which engineering structures are exposed.

Major Gaillard, the author of this book, was for several years engaged upon works of harbour improvement on the South Atlantic coast and the Great Lakes of America.

Although the waves to be dealt with in Lake Superior are not of the magnitude of those in the open sea, yet the author's observations cover waves of various dimensions extending up to 300 feet in length and 23 feet in height, and the results are recorded of several hundred observations of their length, height, period, and depth in which they broke and to which their effect extended. Numerous examples are also given of the effect of waves in moving large masses of stone and other material. The force of the waves breaking on piers, and other marine structures, was measured both by the marine dynamometer of the class used by Mr. Thomas Stevenson more than half a century ago and also by dynamometers of special construction made under the author's directions. The general type of the Stevenson dynamometer used had discs of from 3 inches to 9 inches, with springs varying in strength from 10 lb. to 50 lb. for every inch of elongation. The greatest dynamical force recorded with these when used at Dunbar, in Scotland, was 7840 lb. per square foot with waves about 20 feet high. These dynamometers only measure the dynamic, and not the static, pressure, and give only a maximum reading for a storm observation, and are affected in their working when there is much sand in the water.

The instruments invented and used by the author, besides the Stevenson type, consisted, in one case, of a steel plate, having an area of one square foot, attached to two elliptical springs similar to those used for carriages, the distance between their centres being 6 inches, the reading of the amount of compression due to the action of the wave being recorded by a rod attached to an index which acted on a paraffin surface. The instrument, before being fixed, was rated by having weights placed on the plates and noting the corresponding compressions. The other dynamometer used by Major Gaillard consisted of a plate covering a square foot attached to a horizontal cylinder filled with water; over the flange of this cylinder was placed a diaphragm of india-rubber $\frac{1}{4}$-inch in thickness, having a face of one square foot. A $\frac{3}{4}$-inch pipe led from the cylinder to a tank located in the observing station on the pier. From this pipe there was a communication to a modified form of Bourdon gauge fixed 19 feet above the centre of the diaphragm, and which registered pressures up to 30 lb. per square inch. Communication with the tank having been shut off, any pressure applied to the diaphragm was transmitted by the confined hydrostatic column to the gauge. More than a thousand readings of wave action were taken with this class of dynamometer while the author was in charge of the works, but only two storms of consequence were encountered. So far as the observations went, the instrument appears to have given satisfactory results.

The text is accompanied by a number of illustrations taken from photographs of waves.

SCIENCE IN EXAMINATIONS FOR THE HIGHER CIVIL SERVICE.

THE kind of education received and the subjects studied by future civil servants must have a great and far-reaching effect upon the influence exerted by the public departments which administer the multitudinous and diverse affairs of our scattered Empire. The methods adopted for the selection of such officers must, therefore, be wisely chosen, and, in any examinations designed to facilitate the process of discrimination between men offering themselves for these positions, the subjects in which candidates are tested must be those appropriately related to the work of the department in which successful candidates will be employed, and, at the same time, those most likely to test essential fitness for public work. These and similar principles have been widely canvassed recently both in public addresses and in the Press. Certain changes in the examinations for the selection of Foreign Office clerks and attachés in the Diplomatic Service are to be introduced, and the new regulations have not met with universal approval. It will assist clearness of thought first to compare briefly the existing regulations for the appointments concerned with those shortly to come into force.

Candidates for clerkships on the establishment of the Foreign Office and for attachéships in the Diplomatic Service will, after July 1, instead of being examined according to special regulations which have governed these appointments hitherto, be required to take the combined examination for open competitions for the Home Civil Service (class i.), India Civil Service, and Eastern Cadetships. This decision profoundly modifies the conditions of selection for service in the Foreign Office and the Diplomatic Service. In the past there have been nine obligatory subjects—arithmetic, handwriting and orthography, English composition, précis writing, French, German, general intelligence, geography, and the history of Europe from 1789 to 1880 inclusive. In addition, candidates have been able to offer any two of the following languages, viz., Latin, Italian, Spanish, Portuguese, Russian, modern Greek, and Arabic. In the examination which such candidates will have to take after July 1 next, papers will be set in thirty-two different subjects, from which a selection must be made by the candidate. French and German will be the only obligatory subjects, and candidates will have to reach a high qualifying standard in translation, composition, and oral examination in both